

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

TURUN PATENTTITOIMISTO OY  
P.O. Box 99  
FIN-20521 Turku  
FINLAND

Date of mailing (day/month/year) 21 December 2001 (21.12.01)															
Applicant's or agent's file reference ÅP2983	<b>IMPORTANT NOTIFICATION</b>														
International application No. PCT/FI00/00562	International filing date (day/month/year) 22 June 2000 (22.06.00)														
<p>1. The following indications appeared on record concerning:</p> <p><input checked="" type="checkbox"/> the applicant    <input checked="" type="checkbox"/> the inventor    <input type="checkbox"/> the agent    <input type="checkbox"/> the common representative</p> <table border="1"> <tr> <td>Name and Address AHRO, Mikko Yliopistonkatu 12 B A 10 FIN-20100 Turku Finland</td> <td>State of Nationality FI</td> <td>State of Residence FI</td> </tr> <tr> <td colspan="3">Telephone No.</td> </tr> <tr> <td colspan="3">Facsimile No.</td> </tr> <tr> <td colspan="3">Teleprinter No.</td> </tr> </table>				Name and Address AHRO, Mikko Yliopistonkatu 12 B A 10 FIN-20100 Turku Finland	State of Nationality FI	State of Residence FI	Telephone No.			Facsimile No.			Teleprinter No.		
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<p>2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:</p> <p><input type="checkbox"/> the person    <input type="checkbox"/> the name    <input checked="" type="checkbox"/> the address    <input type="checkbox"/> the nationality    <input type="checkbox"/> the residence</p> <table border="1"> <tr> <td>Name and Address AHRO, Mikko Aleksis Kiven katu 48 A 14 FIN-00510 Helsinki Finland</td> <td>State of Nationality FI</td> <td>State of Residence FI</td> </tr> <tr> <td colspan="3">Telephone No.</td> </tr> <tr> <td colspan="3">Facsimile No.</td> </tr> <tr> <td colspan="3">Teleprinter No.</td> </tr> </table>				Name and Address AHRO, Mikko Aleksis Kiven katu 48 A 14 FIN-00510 Helsinki Finland	State of Nationality FI	State of Residence FI	Telephone No.			Facsimile No.			Teleprinter No.		
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Teleprinter No.															
<p>3. Further observations, if necessary:</p>															
<p>4. A copy of this notification has been sent to:</p> <table> <tr> <td><input checked="" type="checkbox"/> the receiving Office</td> <td><input type="checkbox"/> the designated Offices concerned</td> </tr> <tr> <td><input type="checkbox"/> the International Searching Authority</td> <td><input checked="" type="checkbox"/> the elected Offices concerned</td> </tr> <tr> <td><input type="checkbox"/> the International Preliminary Examining Authority</td> <td><input type="checkbox"/> other:</td> </tr> </table>				<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:						
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The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer  N. Wagner  Telephone No.: (41-22) 338.83.38														

2000-09-04 09:00:00

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION  
(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 23 February 2001 (23.02.01)	
International application No. PCT/FI00/00562	Applicant's or agent's file reference ÅP2983
International filing date (day/month/year) 22 June 2000 (22.06.00)	Priority date (day/month/year) 22 June 1999 (22.06.99)
Applicant KALLIO, Heikki et al	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

15 January 2001 (15.01.01)

in a notice effecting later election filed with the International Bureau on:

\_\_\_\_\_

2. The election  was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  Claudio Borton
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

REC'D 05 OCT 2001

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

WIPO PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AP2983	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00562	International filing date ( <i>day/month/year</i> ) 22.06.2000	Priority date ( <i>day/month/year</i> ) 22.06.1999
International Patent Classification (IPC) or national classification and IPC7 G01N 33/12, G01N 21/35		
Applicant Kallio Heikki et al		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of _____ sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>

Date of submission of the demand 15.01.2001	Date of completion of this report 20.09.2001
Name and mailing address of the IPEA/SE The International Preliminary Examining Authority P.O. Box 503 S-171 55 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Carolina Palmcrantz/BS Telephone No. 08-782 25 00

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00562

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

 the international application as originally filed the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under article 19

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the drawings:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

 the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in written form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4.  The amendments have resulted in the cancellation of: the description, pages \_\_\_\_\_ the claims, Nos. \_\_\_\_\_ the drawings, sheet/fig \_\_\_\_\_5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00562

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	<u>1-7</u>	YES
	Claims	_____	NO
Inventive step (IS)	Claims	_____	YES
	Claims	<u>1-7</u>	NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims	_____	NO

## 2. Citations and explanations (Rule 70.7)

The present application pertains to a method for the analysis of a volatile compound present in a nutritive product (e.g. skatole or androstenone) in a stage of treatment. The method is carried out *on-line* by direct inlet gas-phase Fourier transform infra red (FT-IR) spectroscopy. The aim of the present invention is to be able to assort various quality classes of the product during production.

The international search report revealed four documents of importance:

D1) WO 8002597 A1 (SLAGTERIERNES FORSKNINGSINSTITUT), 27 November 1980 (27.11.80), page 10, lines 9-16, 31-38

D2) WO 8300928 A1 (SLAGTERIERNES FORSKNINGSINSTITUT), 17 March 1983 (17.03.83)

D3) Meat Science, Volume 32, 1992, H. Ville et al: "A Technique for Muscle Biopsy Sampling on Pigs to Assess Intramuscular Fat", page 123 - page 129

D4) Analysis of foods and beverages: Modern techniques. ed. Charalambous G. Academic Press, Volume 17, 1984, R. A. Sanders, "Applications of Fourier Transform Infrared Spectroscopy in the Field of Foods and Beverages", page 553- page 583, especially page 581

.../...

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V

D1 concerns a method for detecting boar taint, i.e skatole or androstenone, by determining IR-spectrophotometrical data for the individual carcasses. The method is useful for on-line utilisation in slaughterhouses (see claim 1 and page 10, lines 9-16 and 31-38). By using this method it is possible to sort out carcasses showing boar taint in a slaughtering line (see page 1, lines 31-33).

The difference between the method according to the present application and the method according to D1 is considered to be that in the former the method is performed by FT-IR spectroscopy while in the latter the method is performed by IR spectroscopy. However, it is considered to be an obvious alternative to a person skilled in the art to use FT-IR instead of IR in the method described in D1 in order to increase the sensitivity and accuracy of the IR technique. This is especially considered to be obvious in view of D4 which discusses the advantages of FT-IR in food industry. Therefore, claims 1-7 of the present application are not considered to involve an inventive step.

D2 pertains to a method of detecting obnoxious taint such as boar taint in carcasses. The method involves reacting an extract of the animal body with a colour reagent and determining the transmittance or absorbance (see claim 1). The method can be used directly in connection with slaughter lines for industrial control and sorting of individual carcasses (see the abstract). However, the method in D2 is not aimed at directly using an IR spectrophotometric method such as FT-IR on-line. Therefore, D2 has been reconsidered to show the general state of the art for claims 1-7.

D3 discloses a technique for muscle biopsy sampling on pigs to assess intramuscular fat. The fat content was determined by FT-IR.

D4 concerns applications of FT-IR spectroscopy in the field of foods and beverages. It is suggested in the document that the use of FT-IR for quantitative multicomponent analyses for quality control will have widespread applications in the food and beverage industry (see pages 556-557 and page 581, second paragraph).

D3 and D4 are considered to show the general state of the art.

*Nesn*  
**(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)**

**(19) World Intellectual Property Organization  
International Bureau**



**(43) International Publication Date  
28 December 2000 (28.12.2000)**

**PCT**

**(10) International Publication Number  
WO 00/79265 A1**

**(51) International Patent Classification<sup>7</sup>:** G01N 33/12, 21/35

**(81) Designated States (national):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

**(21) International Application Number:** PCT/FI00/00562

**(84) Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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991417 22 June 1999 (22.06.1999) FI

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**(74) Agent:** TURUN PATENTTITOIMISTO OY; P.O. Box 99, FIN-20521 Turku (FI).

**Published:**

- *With international search report.*
- *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**WO 00/79265 A1**

**(54) Title: METHOD FOR THE ANALYSIS OF A NUTRITIVE PRODUCT**

**(57) Abstract:** The invention relates to a method for the analysis of a nutritive product in a stage of treatment, in respect of a volatile or volatilisable compound present in or derived from said nutritive product. A sample of said nutritive product is taken, optionally prehandled and subjected to analysis. According to this invention, the analysis is carried out by a direct inlet FT-IR method fast enough to make the result of the analysis available to the stage of treatment while the analysed product still is in said stage of treatment.

## METHOD FOR THE ANALYSIS OF A NUTRITIVE PRODUCT

### FIELD OF THE INVENTION

This invention relates to a method for the analysis of a nutritive product in a stage of treatment, in respect of a volatile or volatilisable compound present in or derived 5 from said product. The invention concerns also a method for assorting the nutritive products on the basis of the result obtained from the analysis.

### BACKGROUND OF THE INVENTION

The food industry encounters a variety of different kinds of unsolved problems involving volatile compounds. Thus there is a common need in various areas of food 10 production for a fast method of analysis of volatile compounds. This need is evident e.g. during raw material breeding, cultivation, growing and selection, but also for process and product quality control, as well as hygiene and shelf life control.

The volatile compounds emitted or released should be analysed, as much as possible, both quantitatively and qualitatively, in their natural state. The information 15 obtained would be useful and beneficial when optimising the safety, nutritive, profitability and sensory properties of the object to be analysed and to achieve a standard-quality raw material, process or product. At any step of the process, from raw material to product, composition of the volatile compounds may correlate with sensory properties of the raw material or product emitting said volatile compounds.

20 An example of such a problem to be solved within the food industry is the occurrence of boar taint as an off odour of pork. Boar taint is an occasionally existing off odour of pork (pig meat) caused by the presence of 3-methylindole

(skatole), 5- $\alpha$ -androst-16-en-3-one (androstenone) and some other minor compounds.

Skatole is a microbial degradation product of amino acid tryptophan in the intestinal tract of pig. However, only male pigs accumulate indolic compounds, such as skatole, in their adipose tissues. Androstene steroids are, again, synthesized in testes and transported by blood circulation in adipose tissues and salivary glands. Thus, the boar taint precursors may exist in several organs in swine, especially in non-castrated boars.

Non-castrated, intact male pigs have higher fattening properties when compared with castrates and gilts. This is due to the effects of androgens. Boar production is thus an economically feasible approach. One limiting factor is that a small proportion of non-castrated male pigs emit the "boar-taint" off-odour during cooking and frying. Also on ethical reasons castration is less and less accepted in pork production.

The accumulation of skatole and androstenone in carcasses depend on several genetical and environmental factors. Production of androstenone depends on the age (sexual maturity) whereas skatole is mainly related to environmental conditions and dietary aspects.

At present, the assessment of existence of off-odorous compounds in carcasses is carried out by sampling and by analysing the sample in a laboratory. The most common methods applied are based on gas chromatographic (GC), high performance liquid chromatographic (HPLC), supercritical fluid chromatography (SFC), enzyme-linked immunoassay (ELISA) and colorimetric analysis of fat (adipose tissue), salivary glands and blood. All these methods require such an amount of sample preparation that none of them is an on-line method of analysis.

The disadvantages related hereto are the considerable time delay from the sampling until the result of the analysis is available. The analysis results are obtained at a time

point when it is too late to use said results for assorting purposes. The analysis results are thus mainly useful for documentation purposes. At present, there is no on-line method of analysis in use for this purpose.

## OBJECTS OF THE INVENTION

- 5    The aim of the present invention is to provide a method for the analysis of a nutritive product in a stage of treatment, in respect of a volatile or volatilisable compound present in or derived from said nutritive product, which method is fast enough to make the result of the analysis available to the stage of treatment while the analysed product still is in said stage of treatment.
- 10   The aim could e.g. be to provide a method for the fast analysis of off-odour compounds from swine carcass, wherein such compounds can be identified by an on-line analysis e.g. in an abattoir directly from the carcasses on a conveyor, after which the carcasses may be assorted according to their sensory quality. The swine carcasses can be assorted without delay in production in various quality classes,
- 15   which is an economically profitable approach.

## SUMMARY OF THE INVENTION

Thus, according to one aspect this invention concerns a method for the analysis of a nutritive product in a stage of treatment, in respect of a volatile or volatilisable compound present in or derived from said nutritive product, wherein a sample of said nutritive product is taken, optionally prehandled and subjected to analysis. According to this invention, the analysis is carried out by a direct inlet gas-phase Fourier transform infra red (FT-IR) spectroscopic method fast enough to make the result of the analysis available to the stage of treatment while the analysed product still is in said stage of treatment.

According to another aspect, this invention relates to a method for assorting a nutritive product in a stage of treatment, and subsequently directing the product to optimal use. The method is characterized by the steps of

- a) identifying pieces of the product,
- 5 b) analysing identified pieces of the product in respect of a volatile or volatilisable compound present in or derived from said product, according to the aforementioned analysis methods of this invention,
- c) labelling the analysed pieces of the product according to the analysis results, and
- 10 d) assorting the product into several classes for different uses.

#### BRIEF DESCRIPTION OF DRAWINGS

Figure 1 shows an FT-IR spectrum of an orange juice sample.

Figure 2 shows an FR-IR spectrum of a sample of coffee.

Figure 3 shows an FT-IR spectrum of a strawberry sample.

- 15 Figure 4 shows an FT-IR spectrum of skatole.

#### DETAILED DESCRIPTION OF THE INVENTION

##### Definition of terms and general description

The wording "nutritive product" shall be understood to mean any edible product for humans or animals, such as foods, feeds, food raw materials and feed raw materials

- 20 of any kind. It shall also be understood to mean all products to be incorporated into

food products such as food ingredients, food supplements as well as compounds comparable to food products such as nutraceuticals.

"Direct inlet gas-phase FT-IR spectroscopic method" shall be understood to mean a Fourier Transformed infrared spectroscopic method in which the sample gas is or  
5 volatiles are injected directly to the spectrometer's sample cell. FT-IR method does not in this context refer to FT-IR coupled with any chromatographic device.

"Stage of treatment" relates to any stage in which the product is handled before it has reached the end consumer or reached a point where no assorting of the product any longer can be carried out. This wording will thus, for example, cover field,  
10 transporting system, storages, factories, storehouses, kitchens, and spaces where the nutritive products are handled, processed or stored.

The analysed parameter is a volatile or volatilisable compound present in or derived from the nutritive product. According to this definition, the compound to be detected may be readily volatile, or it may be volatilisable upon certain measures  
15 such as suitable heating, gas rinsing or application of reduced pressure, for example. This definition covers also the preparation of a derivative of said compound, where said derivative is readily volatile or volatilisable as mentioned above.

The aim of the analysis is to detect and optionally also quantify volatile compound of the product, or to determine the susceptibility of the product to form volatile  
20 compounds, where said volatile compounds are biologically active, odorous, or indicative, e.g. indicate that a product has been destroyed by micro-organisms, although that no off-odour can be noticed.

The aim of the analysis may be to pick out pieces of products releasing unwanted volatile compounds so that such pieces are prevented from reaching the batch of  
25 excellent quality. Instead, such pieces are directed to an appropriate use, or, in the worst case, destroyed.

On the other hand, the aim of the analysis may be to pick out pieces of products releasing highly desirable volatile compounds so that such pieces can be classified as products of particularly good quality.

If the volatile compounds analysed are quantified, then the product can be divided

5 into many classes depending on the concentration of the volatile compound.

The sampling can be carried out manually or automatically.

It is essential that the analysis is carried out by direct inlet gas-phase FT-IR method fast enough to make the result of the analysis available to the stage of treatment while the analysed product still is in said stage of treatment. The acceptable delay

10 from sampling until delivery of analysis results depends on the stage of treatment in question. In a rapid transport conveyor, the delay may be seconds or parts thereof. If the stage of treatment is storage, then the acceptable delay may be much longer. Anyway, it is essential that the result is delivered in sufficiently good time so that the result obtained can be used for decision making, not only for documentation, in  
15 said stage of treatment.

The spectrum obtained is preferably compared to reference spectra in a spectral library in a data processing unit.

According to one embodiment, the analysis is carried out to determine one or several predetermined known compounds.

20 According to an alternative embodiment, the analysis is carried out to determine whether a compound or mixture of compounds, which gives rise to a predetermined spectrum, is present in or derivable from the nutritive product.

The analysis method according to this invention is particularly useful for the investigation of an animal carcass, especially a swine carcass on a conveyor in a

25 slaughterhouse, wherein the carcass is analysed in respect of off-odours, especially skatole and/or androstenone. When the analysis result is available before the carcass

has reached a switch point for selection of track, a carcass with too high concentration of the unwanted volatile compound can be prevented from reaching the line for first class swine meat.

Based on the use of the analysis method according to this invention, it is possible to  
5 assort a nutritive product in a stage of treatment, and to subsequently direct the product to optimal use. The assorting step can be carried out manually or automatically, depending on the acceptable time delay in the said stage of treatment. The choice of the appropriate use may be guided by, for example, safety, nutritional, economical ethical, sensory or other reasons. Pieces of the products are identified  
10 (i.e. equipped with an identification number or the like), analysed, labelled according to the result from the analysis, and finally assorted according to the label, into several predetermined classes destined for different uses.

In case the product to be studied and assorted is an animal carcass, e.g. a swine carcass on a conveyor in a slaughterhouse, then each carcass is identified, analysed  
15 in respect of off-odours, especially skatole and/or androstenone, labelled and directed on a suitable track at a switch point in the conveyor.

If the product to be studied and assorted is fruit, vegetables, and other products comprising a great amount of pieces, then it may be sufficient to identify, analyse and label just a representative amount of pieces of the product.

20 The invention is illustrated more in detail by the following non-limiting examples.

### **Example 1**

The slaughtered pigs on a conveyor are individually marked so that they can be identified manually or automatically. A sample of the carcass, e.g. a biopsy of the neck fat, will be taken. The sample is then transferred into one of the Fourier-

25 transform infra red (FT-IR) analysers. The sample is treated in a proper way to

introduce the volatile compounds to be analysed into the measuring unit, e.g. heating the sample in a suitable way. The results are handled in a data process unit.

After data processing the final rating information together with the identification code will be sent to the switch point(s) of the conveyor to direct the carcass on the  
5 selected track.

### **Example 2**

This example describes a similar analysis and assorting process as that of Example 1, using a low resolution FT-IR analyser GASMET™ combined with CALCMET™ multi-component analysis system to analyse the content of skatole in  
10 the biopsy taken from neck fat of the carcass, which sample is heated and the volatiles introduced into the analyser. An FT-IR spectrum of skatole (Fig. 4) measured by GASMET™ is used as the library spectrum for CALCMET™, which spectrum does show impurities, e.g. water and carbon dioxide.

### **Example 3**

15 FT-IR spectra of nutritive products are typically highly specific as demonstrated by Fig. 1–4. Fig. 1 is a FT-IR spectrum of a sample of orange juice showing absorbance versus wave number. Correspondingly Fig. 2 is a FR-IT spectrum of a sample of coffee and Fig. 3 of strawberry.

Table 1 below further demonstrates that nutritive products can be characterized  
20 based on their volatiles. Different varieties of strawberries definitely show a different profile of volatiles.

**Table 1** Significance of differences ( $p<0.05$ ) of six different strawberry varieties grown in 1998. Different letters in the columns indicate the statistical differences between strawberry varieties in relative amount of certain volatile compounds determined from the vapour phase of strawberries.

Strawberry variety	Acetone	Ethyl butanoate	Ethyl acetate	Ethanol	Methanol	Butane-2,3-dione	Acetaldehyde	Pentan-2-one	Heptan-2-one	cis-3-hexenol	Hydroxyfuranone <sup>1</sup>	Methyl butanoate	Methoxyfuranone <sup>2</sup>
Senga	B	B	A	A	A	C	AB	C	B	A	B	A	A
Jonsok	B	C	BC	A	AB	A	B	D	A	A	B	A	A
Korona	A	A	BC	A	AB	B	C	C	B	A	B	A	A
Polka	A	A	CD	A	AB	C	BC	A	B	A	C	A	A
Honeoye	B	A	AB	A	B	D	D	A	C	A	A	A	A
Bounty	A	A	D	A	AB	BC	C	B	B	A	BC	A	A

<sup>1</sup> = 2,5-dimethyl-4-hydroxy-3(2H)-furanone, <sup>2</sup> = 2,5-dimethyl-4-methoxy-3(2H)-furanone

It will be appreciated that the methods of the present invention can be incorporated in the form of a variety of embodiments, only a few of which are disclosed herein. It  
5 will be apparent for the specialist in the field that other embodiments exist and do not depart from the spirit of the invention. Thus, the described embodiments are illustrative and should not be construed as restrictive.

**CLAIMS**

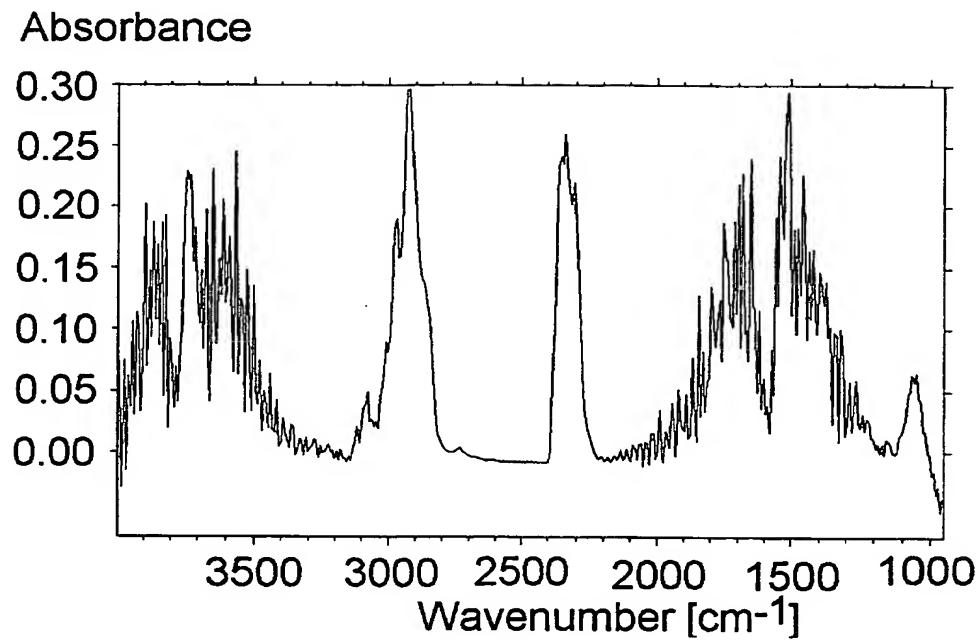
1. A method for the analysis of a nutritive product in a stage of treatment, in respect of a volatile or volatilisable compound present in or derived from said nutritive product, wherein a sample of said nutritive product is taken, optionally prehandled and subjected to analysis, **characterized** in that the analysis is carried out by a direct inlet gas-phase Fourier transform infra red (FT-IR) spectroscopic method fast enough to make the result of the analysis available to the stage of treatment while the analysed product still is in said stage of treatment.
2. The method according to claim 1, **characterized** in that the spectrum obtained is compared to a reference spectrum or reference spectra in a spectral library in a data processing unit.
3. The method according to claim 1 or 2, **characterized** in that the analysis is carried out to determine one or several predetermined known compounds.
4. The method according to claim 1, 2 or 3, **characterized** in that the analysis is carried out to determine whether a compound or mixture of compounds, which gives rise to a predetermined spectrum, is present in or derivable from the nutritive product.
5. The method according to any of the foregoing claims, **characterized** in that the nutritive product is an animal carcass, especially a swine carcass on a conveyor in a slaughterhouse, and that the carcass is analysed in respect of off-odours, especially skatole and/or androstenone, and that the analysis result is available before said carcass has reached a switch point for selection of track.

6. A method for assorting a nutritive product in a stage of treatment, and subsequently directing the product to optimal use, **characterized** by the steps of

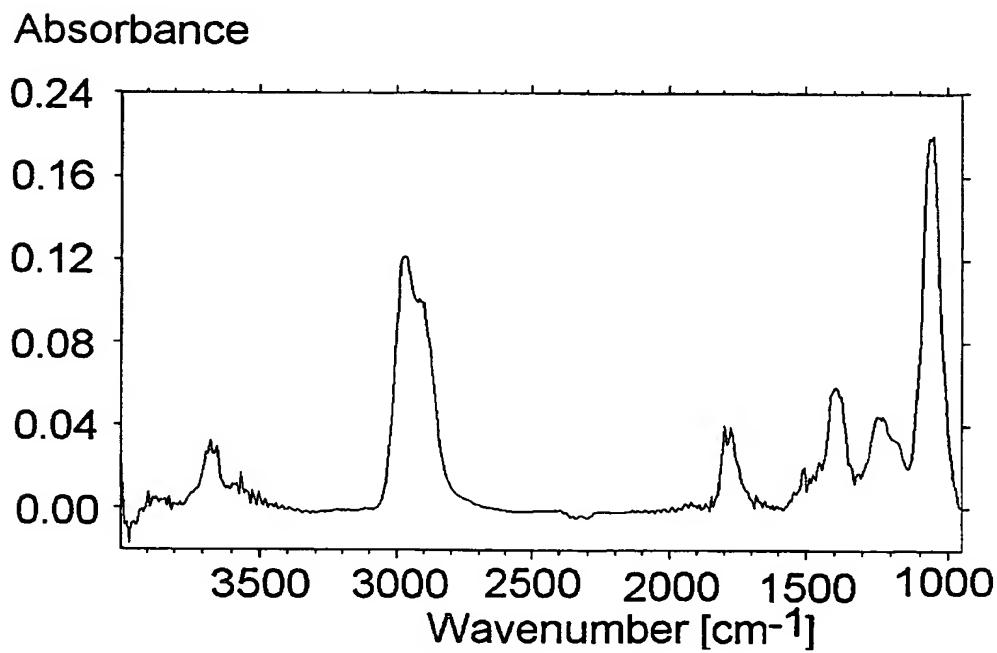
- a) identifying pieces of the product,
- b) analysing identified pieces of the product in respect of a volatile or volatilisable compound present in or derived from said product, according to any of the methods of claims 1 to 6,
- c) labelling the analysed pieces of the product according to the analysis results, and
- d) assorting the product into several classes for different uses.

7. The method according to claim 6, **characterized** in that the nutritive product is swine carcasses on a conveyor in a slaughterhouse, and that each carcass is identified, analysed in respect of off-odours, especially skatole and/or androstenone, labelled and directed on a suitable track at a switch point in the conveyor.

1/2

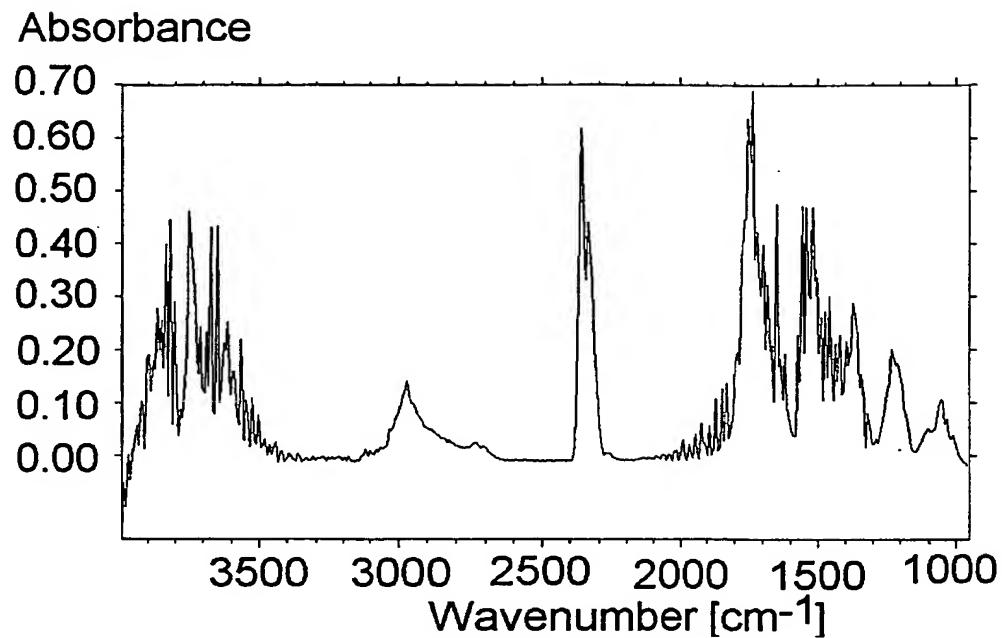
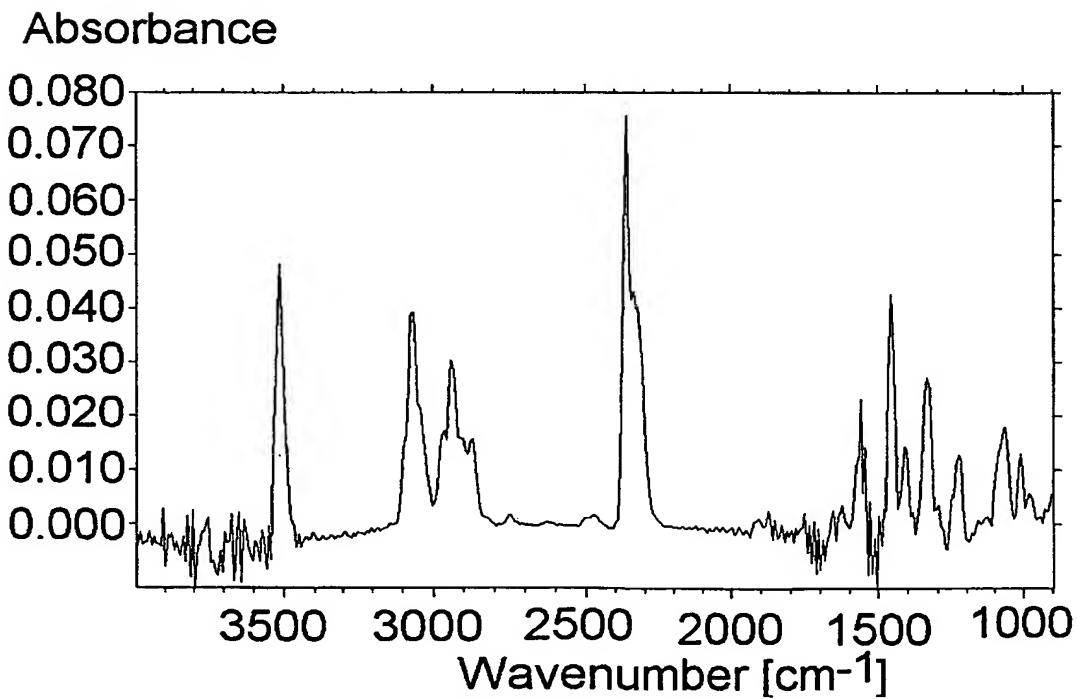


**Fig. 1**



**Fig. 2**

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**Fig. 3****Fig. 4**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/FI 00/00562

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: G01N 33/12, G01N 21/35**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: G01N**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8002597 A1 (SLAGTERIERNES FORSKNINGSIINSTITUT), 27 November 1980 (27.11.80), page 10, lines 9-16, 31-38 --	1-7
X	WO 8300928 A1 (SLAGTERIERNES FORSKNINGSIINSTITUT), 17 March 1983 (17.03.83) --	1-7
A	Meat Science, Volume 32, 1992, H. Villé et al, "A Technique for Muscle Biopsy Sampling on Pigs to Assess Intramuscular Fat" page 123 - page 129 --	1-7

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

21 October 2000

Date of mailing of the international search report

24-10-2000

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## INTERNATIONAL SEARCH REPORT

International application No. PCT/FI 00/00562
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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p><b>Analysis of foods and beverages: Modern techniques.</b>  ed. Charalambous G. Academic Press, Volume 17,  1984, R. A. Sanders, "Applications of Fourier  Transform Infrared Spectroscopy in the Field of  Foods and Beverages", page 553- page 583,  especially page 581</p> <p style="text-align: center;">-- -----</p>	1-7

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

03/10/00

International application No.

PCT/FI 00/00562

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 8002597 A1	27/11/80	DK 145356 B,C DK 202979 A EP 0028617 A US 4384206 A	01/11/82 17/11/80 20/05/81 17/05/83
<hr/>			
WO 8300928 A1	17/03/83	AT 19156 T AU 552431 B AU 8901682 A CA 1186977 A DD 202762 B DE 3270432 D DK 155200 B,C DK 203483 A DK 398181 A EP 0088103 A,B SE 0088103 T3 ES 515564 A ES 8306879 A IE 53497 B IT 1156516 B IT 8268076 D JP 2051136 B JP 58501520 T US 4563428 A	15/04/86 29/05/86 28/03/83 14/05/85 12/01/95 00/00/00 27/02/89 06/05/83 10/03/83 14/09/83  01/06/83 16/09/83 23/11/88 04/02/87 00/00/00 06/11/90 08/09/83 07/01/86
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